



⑫ **EUROPEAN PATENT SPECIFICATION**

④⑤ Date of publication of patent specification :  
**05.06.91 Bulletin 91/23**

⑤① Int. Cl.<sup>5</sup> : **F16L 41/08, B60T 11/16**

②① Application number : **87306624.5**

②② Date of filing : **27.07.87**

⑤④ **Pressure cylinder pipe coupling.**

③⑦ Priority : **25.07.86 GB 8618235**

④③ Date of publication of application :  
**27.01.88 Bulletin 88/04**

④⑤ Publication of the grant of the patent :  
**05.06.91 Bulletin 91/23**

⑥④ Designated Contracting States :  
**DE ES FR GB IT**

⑤⑥ References cited :  
**EP-A- 0 225 421**  
**DE-A- 2 817 438**  
**GB-A- 2 083 583**  
**US-A- 4 553 776**

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**EP 0 254 597 B1**

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## Description

This invention relates to a pressure cylinder of plastics material, such as a master cylinder or wheel cylinder for use in a vehicle hydraulic braking system for example, and is particularly concerned with the connection of a pressure fluid supply pipe to a port of such a cylinder.

Cylinders of plastics material are not capable of withstanding the stresses imposed by the conventional arrangement employed in metal pressure cylinders in which a pipe nut engaged in a threaded aperture formed in the cylinder body and tightened to clamp a flared portion of a supply pipe against a seat in the body. Attempts have been made to adapt this conventional arrangement for use with plastic pressure cylinders. In one such adaptation, a separate threaded component is inserted into a guide formation in the plastic cylinder body and receives a pipe nut which clamps a flared pipe end against a seat formed in the body. Although the inserted component sustains the torque arising at the threaded connection between the pipe nut and component, the cylinder body is still required to react the high clamp loading at the pipe flare seat. This can be unsatisfactory in practice because of the long term tendency of plastics materials to "creep" away from highly stressed areas, which can give rise to the pipe nut becoming loose with the consequent risk of fluid leakage.

In another adaptation of the conventional pipe nut arrangement, a separate seat member is used in addition to a threaded component, the flared pipe end being clamped against the seat member by a pipe nut screwed into the threaded component, as before. This arrangement exhibits the disadvantage that the separate seat member may be lost in transit or inadvertently omitted during assembly, or when the pipe connection is made, and this can have potentially dangerous consequences in an hydraulic system used for vehicle brake actuation, for example.

An object of the invention is to facilitate the connection of a hydraulic supply pipe to a pressure cylinder of plastics material whilst avoiding the disadvantages referred to above. A further object is to provide a method of making an hydraulic pressure cylinder of plastics material which is suitable for forming such a connection.

According to one aspect of the invention, a method of making a pressure cylinder comprises moulding from plastics material a body having a cylindrical pressure-receiving chamber therein, a fluid port in communication with said chamber and a socket in communication with the port, placing within the socket an insert intended to form a connection with a pipe to be connected to the cylinder, the insert having an external locking formation for cooperation with the body, providing a sealing element between surfaces of the insert and body, and locking the insert axially

and rotationally relative to the body by way of said locking formation, a method being characterised by use of a unitary insert having an integral seat for engagement by a corresponding seat on the pipe, and in that the insert is inserted within the socket by urging the body and insert together axially with the simultaneous application of sonic or ultra-sonic vibration in order to cause entry of the insert into the socket and deformation of body material into engagement with said locking formation in order to lock the insert axially and rotationally relative to the body.

This arrangement enables both the long term torque in the screw threads and the clamping force at the seat to be sustained entirely by the insert without the use of additional components, the plastic body merely serving to provide the required axial and rotational restraint and being subjected only to short term forces such as those arising from tightening the pipe nut upon assembly, or hydraulic pressure force acting on the insert, in use.

Preferably, the socket is of generally circular form. In one convenient arrangement, the insert provides a formation with an axially outwardly facing surface engaged by an opposed corresponding surface on the body to provide axial restraint of the insert.

From another aspect of the invention, a pressure cylinder made by the method of the invention comprises a body moulded from plastics material, a unitary insert engaged within the formed body and restrained to preclude rotational and axial movement thereof, the insert serving to form a connection with a pipe to be connected to the cylinder and which is retained, in use, within the body by retention means cooperating with the insert, and a sealing element between surfaces of the insert and the body, the cylinder being characterised in that the insert is of unitary nature with the seat formed integrally therewith, and in that the rotational and axial restraint of the insert relative to the body is effected by cooperation of the material of the body within the socket with an external locking formation on the insert by deformation of the body material into engagement with said locking formation as a result of the application of sonic vibration during insertion of the insert into the body.

In one convenient form of the method, said sealing element is assembled on and carried by the insert prior to insertion of the insert within the socket.

The invention will now be described, by way of example, with reference to the accompanying drawings in which :

Figure 1 is a transverse cross-section through part of one form of the pressure cylinder of the invention,

Figure 2 is a side view of a component of the cylinder of Figure 1, and

Figure 3 is a cross-section along the line III-III of Figure 1 ;

Referring to the drawings, the pressure cylinder

partly illustrated therein has a body 1 formed of plastics material and containing a cylindrical pressure chamber 2 which, in use, receives a slidable piston (not shown) for pressurising fluid contained within the chamber, in conventional manner. The body is provided with a boss 3 within which is formed a generally cylindrical recess 4 containing an insert 5 of relatively tough material such as metal. The recess 4 communicates with the cylinder 2 via a passage 6 and the insert 5 serves for the connection to the body of a hydraulic fluid supply pipe 7 by means of a conventional pipe nut 8 screwed into a threaded bore 9 of the insert. The insert contains a conical seat 10 engaged, in use, by a conventionally flared pipe end 11, the latter being urged against the seat 10 by screwing the pipe nut 8 into the insert. The insert 5 has a concentric projecting hollow spigot 12 closely received within a relatively small diameter bore portion 13 of the body and a resilient sealing element 14, illustrated as an O-ring, surrounds the spigot 12 within a peripheral groove 15 thereof and engages an adjacent wall of the recess 13. The seal 14 acts to prevent fluid leakage from the pressure cylinder 2 around the insert 5.

Rotational restraint for the insert within the body is provided by a series of longitudinal flutes 16 on the insert, the sides of which flutes are engaged by the material of the body to effect rotational keying, as can be seen from Figure 3. The flutes 16 are divided longitudinally by a circumferential groove 17 in which an annular portion 18 of the body material engages to provide axial restraint of the insert within the body. Between the spigot 12 and flutes 16 is a cylindrical portion 19 which terminates, at its free end, in a larger diameter shoulder 20 and carries a projecting rib 2, the latter providing further axial keying of the insert within the body.

The pressure cylinder of Figure 1 to 3 is made by moulding the pressure cylinder 1 from plastics material, as by an injection moulding technique for example. The moulded body is formed with the cylindrical recess 4 of which the diameter is slightly smaller than the maximum external diameter of the insert 5. The seal 14 is placed in the groove 15 and the insert placed against the mouth of the recess with the spigot extending within the recess.

The insert and/or body is then subjected to a suitable conventional sonic or ultra-sonic vibration technique whilst the two components are urged together axially, the vibration causing displacement of the body material so as to permit entry of the insert and seal assembly into the recess and keying of the body material with the flutes 16 and groove 17 to lock the insert to the body both rotationally and axially. A portion 22 of the body material also lodges against an axially facing shoulder 23 formed near the outer end of the insert.

The pipe 7 may subsequently be fitted using the pipe nut 8 in the manner described above. It is possible

to use separate mechanical means to supplement the axial and/or rotational restraint between the insert and body. One example of such means is a pin 33, housed in facing half grooves formed respectively in the insert and body.

In the embodiment described, after the initial tightening of the nut 8, both the long-term torque between the nut and insert and the clamping force applied to the seat 10 are sustained by the insert and the problems relating to conventional arrangements discussed herein are thereby overcome. The invention will be seen to provide a simple and effective means of forming a pipe coupling on a pressure cylinder. The assembly of the insert after moulding of the cylinder body has been completed simplifies the moulding procedures required and reduces the time required for moulding. This technique also enables the insert to be fitted in a controlled manner and tested during assembly and the presence and effectiveness of the seal 14 can also be checked at the assembly stage, following which there is no possibility of the seal being removed or displaced prior to installation of the cylinder in its location of use, as for example on a vehicle.

## Claims

1. A method of making a pressure cylinder, comprising moulding from plastics material a body (1) having a cylindrical pressure-receiving chamber (2) therein, a fluid port (6) in communication with said chamber (2) and a socket (4) in communication with the port (6), placing within the socket (4) an insert (5) intended to form a connection with a pipe (7) to be connected to the cylinder, the insert having an external locking formation for cooperation with the body, providing a sealing element (14) between surfaces of the insert and body, and locking the insert axially and rotationally relative to the body by way of said locking formation, the method being characterised by the use of a unitary insert (5) having an integral seat (10) for engagement by a corresponding seat (11) on the pipe (7), and in that the insert is inserted within the socket by urging the body and insert together axially with the simultaneous application of sonic or ultra-sonic vibration in order to cause entry of the insert into the socket and deformation of body material into engagement with said locking formation in order to lock the insert axially and rotationally relative to the body.

2. A method according to Claim 1, wherein the sealing element (14) is assembled on and carried by the insert (5) prior to insertion of the insert (5) within the socket (4).

3. A method according to Claim 1 or Claim 2, characterised in that the body (1) is heated to a temperature at which softening of the plastic occurs prior to insertion of the insert (5) in the socket.

4. A pressure cylinder made by the method of any one of Claims 1 to 3, and comprising a body (1) moulded from plastics material, a unitary insert (5) engaged within the formed body and restrained to preclude rotational and axial movement thereof, the insert serving to form a connection with a pipe (7) to be connected to the cylinder and which is retained, in use, within the body by retention means (8) cooperating with the insert, and a sealing element (14) between surfaces of the insert and the body the cylinder being characterised in that the insert is of a unitary nature with the seat (10) formed integrally therewith, and in that the rotational and axial restraint of the insert relative to the body is effected by cooperation of the material of the body within the socket with an external locking formation (16) on the insert by deformation of the body material into engagement with said locking formation as a result of the application of sonic vibration during insertion of the insert into the body.

5. A pressure cylinder according to Claim 4, characterised in that the seal (14) is carried by the insert and engages the body.

6. A pressure cylinder according to Claim 4 or Claim 5, characterised in that the socket (4) is of generally circular form to receive the insert (5).

7. A pressure cylinder according to any one of Claims 4 to 6, characterised in that the insert (5) provides a formation (17) with an axially outwardly facing surface engaged by an opposed corresponding surface on the body for axial restraint of the insert.

8. A pressure cylinder according to any one of Claims 4 to 7, characterised in that the rotationally restraining formation (16) on the insert comprises two groups of formations separated by a circumferentially extending groove (17) of which one of the side faces co-operates with material (18) of the body to provide axial restraint.

9. A pressure cylinder according to any one of Claims 4 to 8, characterised in that the insert (5) has a projecting relatively small diameter spigot (12) which is closely received with a corresponding bore portion (13) of the body, the spigot (12) being closely surrounded by said seal (14) which engages an internal wall of the body.

10. A pressure cylinder according to Claim 9, characterised in that said spigot (12) is hollow and serves to provide a passage between part of the insert receiving the pipe and a port (6) leading into a pressure cylinder (2) of the body (1).

11. A pressure cylinder according to Claim 9 or Claim 10, characterised in that said seal (14) is housed in an external groove (15) of the spigot.

12. A pressure cylinder according to any one of Claims 4 to 11, characterised in that said retention means is a pipe nut (8) co-operating with a threaded portion (9) of the insert (5).

## Ansprüche

1. Verfahren zur Herstellung eines Druckzylinders, umfassend das Gießen eines Körpers (1), der eine darin befindliche zylindrische Druckaufnahmekammer (2), einen mit der Kammer (2) in Verbindung stehenden Fluidkanal (6) und einen mit dem Kanal (6) in Verbindung stehenden Rohrstutzen (4) aus Plastikmaterial aufweist, das Einsetzen eines Einsatzes (5), der mit einem mit dem Zylinder zu verbindenden Rohr (7) eine Verbindung herstellen soll, in den Rohrstutzen (4), wobei der Rohrstutzen eine externe Verriegelungsausformung für die Zusammenwirkung mit dem Körper besitzt, die Schaffung eines Dichtungselementes (14) zwischen den Oberflächen des Einsatzes und des Körpers und die Verriegelung des Einsatzes in axialer Richtung und in Drehrichtung relativ zum Körper anhand der Verriegelungsausformung, wobei das Verfahren gekennzeichnet ist durch die Verwendung eines einteiligen Einsatzes (5) mit einem angegossenen Sitz (10) für eine Verbindung mit einem entsprechenden Sitz (11) am Rohr (7) und dadurch, daß der Einsatz in den Rohrstutzen eingesetzt wird, indem der Körper und der Einsatz unter gleichzeitiger Anwendung einer Schall- oder Ultraschallvibration zusammengetrieben werden, um den Eintritt des Einsatzes in den Sockel und eine zur Verbindung mit der Verriegelungsausformung führende Verformung des Körpermaterials zu bewirken, um den Einsatz in axialer Richtung und in Drehrichtung relativ zum Körper zu verriegeln.

2. Verfahren gemäß Anspruch 1, dadurch gekennzeichnet, daß das Dichtungselement (14) vor dem Einsetzen des Einsatzes (5) in den Rohrstutzen (4) am Einsatz (5) montiert und von diesem gehalten wird.

3. Verfahren gemäß Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Körper (1) vor dem Einsetzen des Einsatzes (5) in den Rohrstutzen auf eine Temperatur erhitzt wird, bei der ein Weichwerden des Kunststoffs auftritt.

4. Druckzylinder, der durch das Verfahren gemäß einem der Ansprüche 1 bis 3 hergestellt wird, mit einem aus Kunststoffmaterial gegossenen Körper (1), einem einteiligen Einsatz (5), der in dem geformten Körper in Eingriff und eingespannt ist, um eine Bewegung in Drehrichtung und in axialer Richtung zu verhindern, wobei der Einsatz der Bildung einer Verbindung mit einem mit dem Zylinder zu verbindenden Rohr (7) dient und während des Gebrauchs im Körper durch mit dem Einsatz zusammenwirkende Haltemittel (8) gehalten wird, und einem Dichtungselement (14) zwischen den Oberflächen des Einsatzes und des Körpers, wobei der Zylinder dadurch gekennzeichnet ist, daß der Einsatz eine Einheit mit dem einteilig mit ihm ausgebildeten Sitz (10) bildet und daß die Einspannung des Einsatzes in Drehrichtung und in axialer Richtung relativ zum Körper durch

das Zusammenwirken des Materials des Körpers im Rohrstutzen mit einer externen Verriegelungsausformung (16) am Einsatz ausgeführt wird, indem als Ergebnis der Anwendung einer Schallvibration während des Einsetzens des Einsatzes in den Körper das Körpermateriale zu einem Eingriff mit der Verriegelungsausformung verformt wird.

5. Druckzylinder gemäß Anspruch 4, dadurch gekennzeichnet, daß die Dichtung (14) vom Einsatz gehalten wird und mit dem Körper in Eingriff gelangt.

6. Druckzylinder gemäß Anspruch 4 oder 5, dadurch gekennzeichnet, daß der Rohrstutzen (4) eine im allgemeinen kreisförmige Form besitzt, um den Einsatz (5) aufzunehmen.

7. Druckzylinder gemäß einem der Ansprüche 4 bis 6, dadurch gekennzeichnet, daß der Einsatz (5) für seine axiale Einspannung eine Ausformung (17) mit einer axial nach außen gerichteten Oberfläche, die mit einer entsprechenden gegenüberliegenden Oberfläche am Körper in Eingriff ist, aufweist.

8. Druckzylinder gemäß einem der Ansprüche 4 bis 7, dadurch gekennzeichnet, daß die Drehung hemmende Ausformung (16) am Einsatz zwei Gruppen von Ausformungen aufweist, die durch eine in Umfangsrichtung sich erstreckende Nut (17) getrennt sind, von der eine Seitenfläche mit dem Material (18) des Körpers zusammenwirkt, um eine axiale Hemmung zu schaffen.

9. Druckzylinder gemäß einem der Ansprüche 4 bis 8, dadurch gekennzeichnet, daß der Einsatz (5) einen vorspringenden Einpreßzapfen (12) mit relativ kleinem Durchmesser besitzt, der von einem entsprechenden Bohrbereich (13) des Körpers eng aufgenommen wird, wobei der Einpreßzapfen (12) von der Dichtung (14), die mit einer Innenwand des Körpers in Eingriff ist, eng umgeben wird.

10. Druckzylinder gemäß Anspruch 9, dadurch gekennzeichnet, daß der Einpreßzapfen (12) hohl ist und dazu dient, zwischen dem das Rohr aufnehmenden Teil des Einsatzes und einem in einen Druckzylinder (2) des Körpers (1) führenden Kanal (6) einen Durchlaß zu schaffen.

11. Druckzylinder gemäß Anspruch 9 oder 10, dadurch gekennzeichnet, daß die Dichtung (14) in einer Außennut (15) des Einpreßzapfens untergebracht ist.

12. Druckzylinder gemäß einem der Ansprüche 4 bis 11, dadurch gekennzeichnet, daß das Haltemittel eine Rohrmutter (8) ist, die mit einem Gewindebereich (9) am Einsatz (5) zusammenwirkt.

## Revendications

1. Procédé de fabrication d'un cylindre sous pression, comprenant le fait de : mouler un corps (1) à partir d'une matière plastique, dans lequel est pratiquée une chambre cylindrique (2) destinée à recevoir la

pression, le corps étant muni d'un orifice pour fluide (6) en communication avec la chambre (2) et d'un manchon (4) en communication avec l'orifice (6) ; placer au sein du manchon (4) une pièce rapportée (5) destinée à mettre en oeuvre un raccordement avec un tuyau (7) à raccorder au cylindre, la pièce rapportée ayant une configuration externe de blocage destinée à coopérer avec le corps ; disposer un élément d'étanchement (14) entre les surfaces de la pièce rapportée et du corps ; et bloquer la pièce rapportée en direction axiale et en rotation par rapport au corps, par l'intermédiaire de la configuration de blocage, ce procédé étant **caractérisé en ce qu'on** utilise une pièce rapportée unitaire (5), munie d'un siège (10) faisant partie intégrante de cette dernière et qui est destiné à venir se mettre en contact avec un siège correspondant (11) du tuyau (7), et **en ce qu'on** insère la pièce rapportée au sein du manchon en pressant le corps et la pièce rapportée, conjointement, en direction axiale, en procédant, simultanément, à l'application de vibrations soniques ou ultrasoniques dans le but de faire entrer la pièce rapportée au sein du manchon et à la déformation de la matière du corps qui vient se mettre en contact avec la configuration de blocage, dans le but de bloquer la pièce rapportée, en direction axiale et en rotation par rapport au corps.

2. Procédé selon la revendication 1, dans lequel on monte l'élément d'étanchement (14) et on le place sur la pièce rapportée (5) avant d'insérer la pièce rapportée (5) au sein du manchon (4).

3. Procédé selon la revendication 1 ou 2, **caractérisé en ce qu'on** chauffe le corps (1) à une température à laquelle s'opère le ramollissement du plastique avant d'insérer la pièce rapportée (5) au sein du manchon.

4. Cylindre sous pression fabriqué par le procédé selon l'une quelconque des revendications 1 à 3 et comprenant : un corps (1) moulé à partir de matière plastique ; une pièce rapportée unitaire (5) qui vient s'engrener au sein du corps façonné et qui est bloquée pour prévenir tout mouvement axial et rotatif de ce dernier, la pièce rapportée servant à mettre en oeuvre un raccordement avec un tuyau (7) destiné à se raccorder au cylindre et qui est retenu, lors de la mise en service, au sein du corps, par un moyen (8) destiné à cet effet et qui coopère avec la pièce rapportée ; ainsi qu'un élément d'étanchement (14) disposé entre les surfaces de la pièce rapportée et du corps, le cylindre étant **caractérisé en ce que** la pièce rapportée est de nature unitaire, le siège (10) faisant partie intégrale de ce dernier et **en ce que** la résistance axiale et en rotation de la pièce rapportée par rapport au corps, est mise en oeuvre par la coopération de la matière du corps au sein du manchon avec une configuration externe de blocage (16) de la pièce rapportée, par le biais d'une déformation de la matière du corps qui vient se mettre en contact avec la configuration de blocage, suite à l'application de

vibrations soniques lors de l'insertion de la pièce rapportée au sein du corps.

5. Cylindre sous pression selon la revendication 4, **caractérisé en ce que** le joint étanche (14) est supporté par la pièce rapportée et vient se mettre en contact avec le corps. 5

6. Cylindre sous pression selon la revendication 4 ou 5, **caractérisé en ce que** le manchon (4) est de forme généralement circulaire, pour que vienne s'y loger la pièce rapportée (5). 10

7. Cylindre sous pression selon l'une quelconque des revendications 4 à 6, **caractérisé en ce que** la pièce rapportée (5) présente une configuration (17) dans laquelle une surface faisant face vers l'extérieur en direction axiale, vient se mettre en contact avec une surface opposée correspondante du corps, dans le but de procurer une résistance axiale à la pièce rapportée. 15

8. Cylindre sous pression selon l'une quelconque des revendications 4 à 7, **caractérisé en ce que** la configuration (16) de résistance en rotation, que présente la pièce rapportée, comprend deux groupes de structures séparées par une rainure (17) s'étendant circonférentiellement, une des faces latérales de cette dernière coopérant avec la matière (18) du corps dans le but de procurer une résistance axiale. 20 25

9. Cylindre sous pression selon l'une quelconque des revendications 4 à 8, **caractérisé en ce que** la pièce rapportée (5) est munie d'un emboîtement (12) faisant saillie et à diamètre relativement étroit, qui vient se loger en ajustage serré dans une portion d'alésage correspondant (13) du corps, l'emboîtement (12) étant entouré en ajustage serré par le joint étanche (14) qui vient s'engrener dans une paroi interne du corps. 30 35

10. Cylindre sous pression selon la revendication 9, **caractérisé en ce que** l'emboîtement (12) est creux et sert à procurer un passage entre la partie de la pièce rapportée dans laquelle vient se loger le tuyau et un orifice (6) conduisant à un cylindre sous pression (2) du corps (1). 40

11. Cylindre sous pression selon la revendication 9 ou 10, **caractérisé en ce que** le joint étanche (14) est logé dans une rainure externe (15) pratiquée dans l'emboîtement. 45

12. Cylindre sous pression selon l'une quelconque des revendications 4 à 11, **caractérisé en ce que** le moyen de retenue est un écrou (8) pour tuyau coopérant avec une portion filetée (9) de la pièce rapportée (5). 50

